



Quantitative Investing: A Perspective of the Last 40 Years

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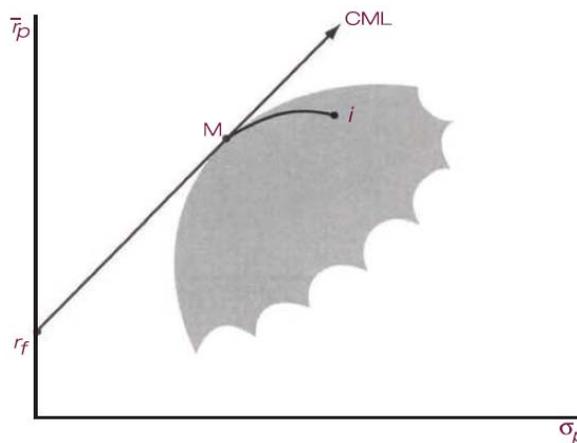
AN ACADEMIC INTRODUCTION

Investing has always required quantitative thinking. But the term “quantitative investing” had its theoretical roots in the academic halls of the mid-1960s. Quantitative investing was the scientific approach to rationalizing the “art” of investment management. The quantitative analyst would construct a model of how the world worked and subsequently test it. No casual empiricism, in which any number of possible explanatory factors might be tested at random to determine which worked best in the past, would be tolerated. Quantitative investing was the beginning of a serious effort to apply process engineering to the institutional investment world.

The 1960s were a wellspring for theoretical innovation in investment finance. Two Nobel Prize winning financial economists developed new methods of modeling return and risk. Harry Markowitz formed a model for diversification by exploring the correlation of various assets in order to minimize risk once having estimated their expected return. Bill Sharpe authored an approach to assessing the forward-looking trade-off between expected return and risk called the Capital Market Line Model (see Figure 1). By the end of the ‘60s, these “efficient market” proponents developed a sophisticated theory to explain the practical behavior of capital markets. The investment management “guild,” long entrenched, was to be replaced by the academics’ index fund.

Figure 1: The Capital Market Line Model

Data source: Sharpe, Alexander and Bailey, Investments, 1995, p. 288



THE '70S: REBELLION FROM TRADITION

Wells Fargo Bank was a hot bed of investment ideas as the decade of the '70s opened. They wanted to take “the theory” public by offering a “closed-end” index fund in 1971. Blyth, Eastman Dillon, the investment bank hired at that time to represent that closed-end fund, was to market this radical index fund idea to the institutional investing world and ultimately assigned me to the task. The idea was too new and too radical. It was viewed as “un-American” and a “formula for mediocrity” versus those who could pick stocks. The rest is history, as they say. With perhaps \$6 trillion in assets, today’s index funds encompass as much as 20% of all managed investment funds. In 1973, after moving out West to work



at Wells Fargo Bank, I became the portfolio manager of the first S&P 500® index fund, with \$1.5 million in assets. At that time, Bill Fouse and I became friends and then partners when we took the idea of starting Mellon Capital to Mellon Bank in 1983.

As the fund grew slowly, it occurred to me that by using these “efficient market” ideas, it was possible to revolutionize equity trading! By trading stocks in “portfolios,” instead of one at a time, the cost of trading could be substantially reduced. This was true because there was far less price volatility at the portfolio level versus individual stocks and thus much less risk. Since the risk was lower, dealers could charge a lower cost to trade (diagrammed below in terms of the bid/ask spread) for providing large amounts of liquidity to trade institutional-sized assets. Since very large amounts of capital could be invested or divested at one time this way, the costs to administer these portfolio trades reflected in the brokerage commission fell sharply. As a result, it became easier to convince the brokerage community that non-research, index fund trades should receive substantially lower commission rates.

Figure 2: Components of Trading Cost

Data source: T. Loeb, “Trading Cost: The Critical Link Between Investment Information and Results,” *Financial Analysts Journal*, May–June 1983, p. 41



In 1975, “portfolio trading” was renamed “program trading” by the Wall Street market makers because it involved buying and selling what they called a “program” of stocks. The timely introduction of negotiated commission rates, together with the convincing rationale for passive trading, drove down commission costs with unrelenting speed. Between 1975 and the end of that decade, index fund commission costs declined from 17.5 cents per share to 3.5 cents per share. Today, program trading comprises about 30% of the volume of the New York Stock Exchange.

The “new financial theory” taught us a great deal about diversification and risk, but how could we produce reasonable return expectations? For those, we had to look far back to 1926 and J. B. Williams’s “Theory of Investment Value.” Williams simply told us that expected return was produced by estimating the forward-looking earnings and dividends of a stock in perpetuity. In 1973, Bill Fouse persuaded the security analysts at Wells Fargo to gather consensus forecasts of earnings for about 200 companies from Wall Street analysts. Then, with some simplifying assumptions, a forward-looking projection of earnings and dividends was cast into Williams’s Dividend Discount Model (shown below). The expected return of each stock was calculated by determining the rate by which this cash flow stream should be discounted back to its current price. It was then possible to market-weight each estimate so that the expected return on the entire stock market was forecast.

Figure 3: The Dividend Discount Model

Data source: W. L. Fouse, “Allocating Assets Across Country Markets,” *Journal of Portfolio Management*, Winter 1992, p. 21

$$P = PV = \frac{D_1}{1 + R} + \frac{D_2}{(1 + R)^2} + \dots + \frac{D_N}{(1 + R)^N}$$

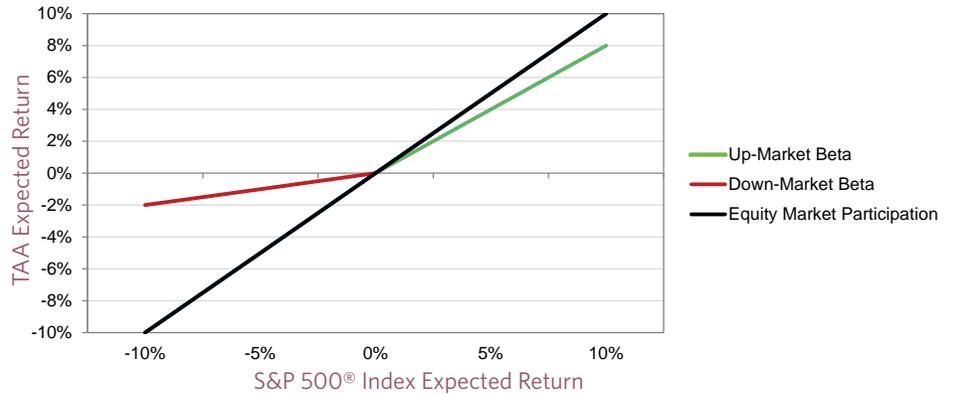
P=price PV=present value D₁=dividend first year D₂=dividend second year, and R=discount rate, or expected return

This ability to forecast the expected return was the key to tactically allocating assets between stocks and bonds. Over the next 40 years, the forward-looking risk premium, or the difference between the expected returns of the stock market and bond market, would play a pivotal role in producing returns eclipsing the stock market return itself.

The "Fouse Model" integrated the expected-return probabilities of the stock and bond markets together with investor risk aversion with the goal of providing downside protection and upside market capture. In 1973, this model was revolutionary because it provided a recommendation that could be implemented in minutes, instead of the cumbersome "committee approach" which required days or weeks of protracted debate as the window of opportunity closed.

**Figure 4: Tactical Asset Allocation Objective:
Up and Down Market Betas**

Up and down markets are defined as periods when the S&P 500® Index experiences a positive or negative return, respectively. The chart shown to the right is for illustrative purposes only and does not reflect actual results

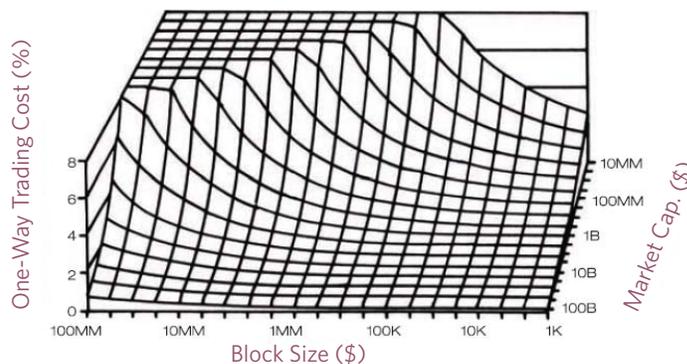


The issue of market liquidity has always had profound implications for large-scale institutional investing. But the issue of measuring and forecasting these costs became controversial during the bull market of the early 1980s. The cost of that liquidity was an important gauge in deciding whether the return expected from investing in a stock or a portfolio of stocks might be substantially eliminated by the cost of accumulating the desired position. Having been a researcher and portfolio manager for the prior decade, it seemed logical to me to estimate the cost of market liquidity by testing the people whose working lives depended on it—the market makers! This approach to estimating trading costs was to elicit from the dealers their market quotations to buy or sell increasingly larger amounts of individual stocks, from the very liquid, large-capitalization companies to the least liquid, small-capitalization companies. In this study, "Trading Cost: The Critical Link Between Investment Information and Results," three important implications were drawn: First, trading costs were far higher than anyone expected, especially for small cap stocks! Second, small cap managers should limit the size of the assets they manage. Third, executing block trades requiring dealer capital was a high-cost approach to the problem, useful perhaps only to those who were trading on "fast information."

In subsequent studies, Wayne Wagner exhaustively measured the cost of market liquidity for millions of institutional trades. He found that the cost increases when the trade size as a percentage of a company's daily trading volume rises. He also confirmed that the cost of trading was higher than investors commonly thought, due to the existence of large opportunity costs.

**Figure 5: Trading Cost: The Critical Link Between
Investment Information and Results**

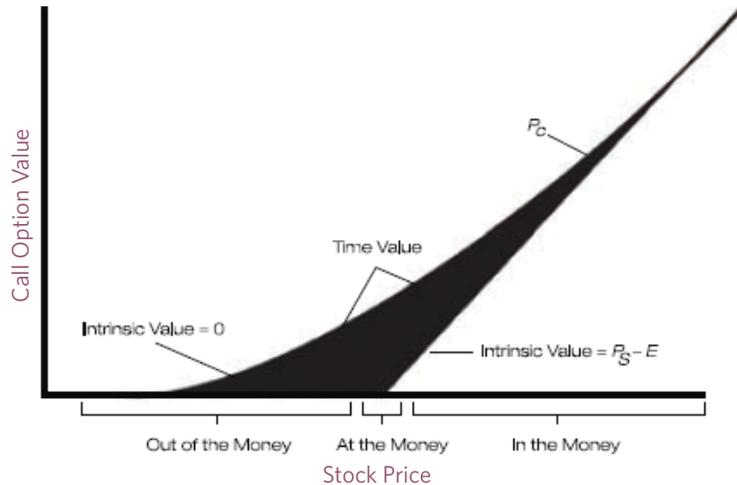
Data source: T. F. Loeb, "Is There a Gift from Small Stock Investing?" Financial Analysts Journal, January–February 1991, p. 42



THE '80S: DERIVATIVES TRADING AND MARKET VOLATILITY

The turbulent bull market of the 1980s presented its share of market liquidity-enhancing investment vehicles. The introduction of index options and futures stemmed from the groundbreaking 1974 research of professors Fischer Black and Myron Scholes. Their famous options pricing model permitted us to value and trade these instruments, which were viewed as “derivatives” of diversified portfolios of stocks, as they comprised published indices. These instruments traded at one-tenth of the cost of a comparable “program trade” of index fund stocks. Huge equity and fixed income exposures, long and short, could be inexpensively implemented so that investors could reflect their forecasts in their portfolios with greater speed.

**Figure 6: The Black-Scholes
Options Pricing Model**
Data source: Sharpe, Alexander and
Bailey, Investments, 1995, p. 695



Futures and options instruments were also used as “synthetics,” vehicles that could turn a fixed income portfolio into an actively managed, equity return strategy. By taking equity exposure using S&P 500® index futures, for example, and investing the collateral in high-yielding, short-term, fixed income instruments, it was possible to enhance market returns. Since S&P 500 index futures are often priced to reflect a lower return on the underlying collateral, an actively managed fixed income strategy could potentially boost the return of the combined fixed income collateral and equity exposure above the S&P 500 index. In 1982, this was the first example of transporting the “alpha” from one market to another. It was the forerunner of a wide variety of investment strategies that are today commonly known as alpha transportation strategies, which seek to separate the market risk of an investment from the skill-based, security-selection component.

Inevitably, however, the technological advances provided by the derivatives markets would lead to enormous concerns regarding market volatility, liquidity and fair play with regard to small investors. The government regulators, congresspeople and the media wondered aloud whether these new technologies amounted to sound investing or alchemy. Many investment professionals regarded these instruments and strategies as a “side game” even as their trading volumes met and exceeded underlying stock trading activity.

As program trading volumes soared in the mid-'80s, the House of Representatives' Finance and Telecommunications Subcommittee, chaired by Edward Markey, held numerous hearings to investigate the sources of market volatility, systemic risk and possible fairness issues in connection with institutional, derivative and program trading. Given my strong commitment to these important innovations, I was asked to provide my best arguments which testified to the economic benefits for individuals in pension plans and mutual funds as well as their favorable implications for market efficiency.

Then, on that fateful day of October 19, 1987, came the famous market break stemming from overvaluation and selling pressure generated by institutional investors executing portfolio insurance strategies. At that point, the legislators had enough ammunition to require significant policy changes to the market mechanism. Working with the Brady Commission, the committee instituted so-called circuit breakers, which gave traders a

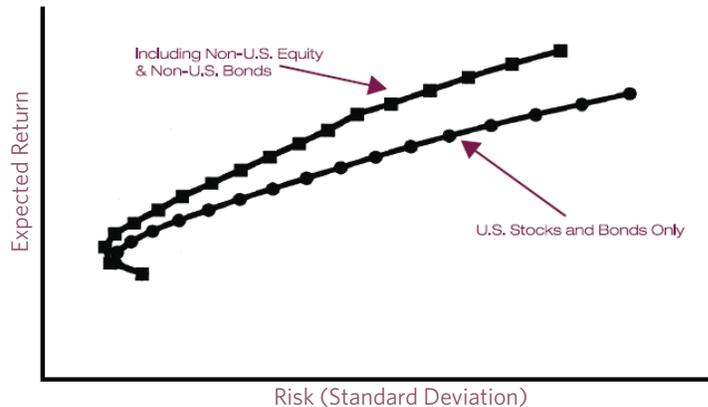
chance to slow down the execution process when the stock market ran fast in periods of sharp decline. This ultimately served to quell the nerves of an anxious public and to eliminate very short-term market volatility by halting trading.

THE '90S: GOING GLOBAL AGAIN!

Toward the end of the 1980s, there was a renewed interest in global investing. American pension funds had their first significant foray into international investing in the mid-1970s after being convinced of the merits of international diversification (shown below). They proceeded to suffer generally under the worldwide equity market doldrums stemming from the oil price-induced stagflation of the late '70s and early '80s. It was not until the early 1990s that well-known consultants began to recommend 10% to 25% of a portfolio's equity allocation to the international equity markets.

Figure 7: Globalizing Your Opportunities

Data source: T. F. Loeb, "Global Investing: The Strategy and Outlook," address to financial analysts, Singapore, August 21, 1998



The 1990s were a decade of rapid growth in global investing by Americans who theretofore had been decidedly insular in their thinking. In developing Mellon Capital's Global Asset Allocation Model, there were extensive challenges to overcome. Recognizing the limitations in cross-border investing, we held firmly to the view that capital markets were segmented and that local investors set the valuation of equity and fixed income asset classes. Our global model, therefore, was largely dependent upon the local risk premium between the expected return of stocks versus bonds in each country market. Second, when consensus forecasts of earnings finally became available in 1988, there were no more than two analyst estimates reported for each company rather than the typical 10 estimates on each U.S. company. Third, the currency risk and return had to be explicitly forecast.

Developing techniques to master the global economics as well as managing a global organizational thrust became the principal endeavor for the decade. Mellon Capital's chief investment officer at that time, Tom Hazuka, developed a conceptual model for currency valuation. He reasoned that currency returns depended on real interest rate differences between country markets. He then tested the notion and found the results overwhelmingly positive in his 1994 article "A Valuation Approach to Currency Hedging."

As the 1990s drew onward and into the new millennium, we recognized that world stock and bond markets had become more integrated. For that reason, our research team incorporated a more balanced set of valuation factors by progressively employing equity to equity market and bond-to-bond market valuation in addition to our equity-to-bond and currency sources. They found that adding information sources with low correlation to one another produced a more consistent and predictable positive return pattern. For most of the decade, investors shackled the global strategy with constraints. These investors prohibited us from underweighting the equity position by more than a country market's weight in the chosen benchmark. Thus, Australia, with 2.4% of the weight in the MSCI global equity benchmark, could, at maximum, be underweighted by only that percentage. In contrast, the United States, with about 52% of the weight, would be permitted a much greater underweight position when it was judged to be extremely overvalued. Furthermore, investors would not allow a currency hedge position unless there was an

equivalent underlying equity or fixed income position. We found that these constraints led systematically to lower returns and greater risk than an unconstrained strategy.

THE MILLENNIUM: ABSOLUTE RETURN AND THE DRIVE FOR ALPHA

The year 2000 brought with it the sharpest market decline since 1973-1974. Stemming from extreme overvaluation, the ensuing decline was deep. It caused investors to set their equity return expectations at relatively low levels. Pension, endowment and individual investors felt that their investment return objectives could not be met with traditional equity and bond exposures. Consequently, a headlong movement toward leveraged absolute return strategies began in earnest. One of the approaches which was used to achieve the consistent positive return performance that absolute return strategies require was to diversify effectively across a number of different portfolio strategies. Funds of hedge funds and multistrategy hedge funds combined a number of single strategies with very low correlation in a limited liability vehicle. Many of these hedge funds employed leverage to amplify their investment returns in order to meet their investment goals. They also permitted short selling in order to take advantage of the full range of information available.

Investors broadened their range of asset class investments with the goal of gaining flexibility and reducing risk. The hedge fund phenomena succeeded in reducing risk substantially through effective diversification of return sources. Equity and fixed income, the traditional asset classes, generally had very low return correlation with currencies, duration neutral bond strategies, market neutral equity strategies and commodity strategies, to name a few. Portfolio construction focused on the blending of asset classes and considered risk in a large set of dimensions. Risk became packaged effectively within a specified "risk budget" that explicitly paired absolute return expectations, so-called alpha, with a measured amount of risk, unrelated to the strategy's market risk, or so-called beta exposure. When alpha and beta were separated, professional managers were compensated for their skill and not simply for assuming market exposure (inexpensively done through S&P 500 futures or an S&P 500® index fund).

Disentangling a portfolio manager's exposure to a particular market from his or her security selection ability is a difficult task. Certain global, multi-strategy managers, like Mellon Capital, make market bets actively, in addition to a broad set of relative value bets. All of these are viewed as potential alpha producing processes in contrast to the maintenance of market exposures passively. Using this process, the sources of alpha have historically retained very low correlation with one another.

2010 AND BEYOND: TOTAL RETURN

The second decade brought with it a heavy dose of pragmatism. After the devastating recession of 2007 and 2008 and the concurrent stock market decline, institutional and individual investors found the economy and their finances in the most fragile condition since the Great Depression. The low return fixed income and equity investment environment caused investors to continue to think more opportunistically about how to achieve the total return to fund their requirements each year.

Investors paid a very high cost for their equity exposure in the downturn. Consequently, their second goal was to manage downside risk more acutely. With inflation and real growth expectations at their lowest in decades, investors concentrated on lowering risk in their portfolios by adopting risk-weighted rather than return-weighted strategies. "Risk-Parity", a strategy which equalized the allocation of capital to each asset class based upon its risk, became widely recognized. Because fixed income produces perhaps one-half of the risk of equities, this strategy allocated roughly two times the capital to bonds versus stocks and employed moderate leverage in the process. In so doing, the risk-parity strategy could produce about the same level of portfolio risk as the traditional 60% equity/40% fixed income policy, while accomplishing the task by assuming that the expected return of each asset class was simply proportional to its risk!

Figure 8: The Evolution of Asset Allocation Approaches

Data source: Mellon Capital



Figure 8 shows the evolution of the total return approach. The traditional capital allocation-weighted strategy of 60 percent equity/40 fixed income allocates 90 percent of the portfolio risk to equities. The risk-parity strategy assumes no ability to forecast return and allocates capital equally to each asset class based upon its estimated risk. It employs a moderate amount of leverage to target the desired portfolio risk level. Finally and importantly, a dynamic total return strategy has as its foundation the benefit of employing tactical forecasts of expected return and risk, while also using a moderate amount of leverage to target the desired portfolio risk level. By utilizing index call options to achieve the additional equity exposure, increased downside risk may be avoided by incurring the cost of the option. Since the fixed income component of the strategy is implemented with sovereign bonds exclusively, downside risk may be further mitigated.

This total return approach has a number of benefits in addition to the focused objective of producing the funding return required. First the investment manager can deploy the portfolio across a diverse set of asset classes opportunistically to manage portfolio risk. Secondly, the manager is not limited by having to manage to a particular benchmark index and can therefore use the best ideas to produce the desired total return. Furthermore, the manager's performance becomes directly aligned with the performance goal of the investor which improves the clarity and focus of the manager's efforts.

In over 40 years of managing investment capital and investment professionals utilizing quantitative investment strategies, 22 as chief executive officer of Mellon Capital, I have learned that common sense, fundamental, economic thinking is unquestionably the key to success. I remain convinced that the rigorous application of quantitative approaches to investing will provide a better understanding of the investment process and increasingly better investment results.



BIOGRAPHY

Thomas F. Loeb

Chairman Emeritus & Co Founder

Thomas F. Loeb is Chairman Emeritus and Co-Founder of Mellon Capital. He has also served as Chairman of the Board of Directors and was Chief Executive Officer of the firm from its inception in 1983 through 2005.

Tom is a recognized authority on quantitative investment strategies and securities trading research. His investment management career spans four decades. Before co-founding Mellon Capital, he led Wells Fargo's pioneering efforts in index fund management, tactical asset allocation, and enhanced equity strategies between 1973 and 1983. He also introduced equity trading strategies that have been widely accepted by both the investment management and brokerage communities.

In 2008, Tom was recognized by Plan Sponsor Magazine as a "Legend in the Retirement Industry." Tom received the prestigious Graham and Dodd Plaque for his article "Trading Cost: The Critical Link Between Investment Information and Results." His research results have been reported in William F. Sharpe's "Investments" textbook. Tom is a noted author of journal articles, including "Is There a Gift from Small-Stock Investing?" published in the Financial Analysts Journal.

Tom is Chairman of the Mellon Capital Risk Management Committee as well as a member of the Board of Directors, Fiduciary Committee and Senior Management Committee.

Tom received his M.B.A. in finance from Wharton, University of Pennsylvania.

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A Philosophical Perspective of the Last 40 Years

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